Discrete Applied Mathematics 13 (1986) 107-108
North-Holland

PRÉCIS

The general theory and application of networks occupies a unique and important role in discrete mathematics. The papers in this special issue have been selected to illustrate a number of the diverse facets of this role, including mathematical procedures, and graph-theoretical methods and algorithms. Each paper makes an interesting contribution to one or more of these facets.

Barros and Weintraub show how a series of equilibrium models for the agro-industrial sector can be modeled and solved as network problems. The focus of their paper is on modeling and solving real world problems. Several interesting applications are presented, and a number of additional ones are outlined. For the single commodity spatial market equilibrium problem, Jones, Saigal, and Schneider develop a variable dimension homotopy algorithm. Their algorithm increases by one the markets brought to equilibrium in each interaction and is implemented using the underlying network structure. Computational results indicate that the algorithm can solve large problems effectively.

Granot and Hassin develop a creative extension of Gomory and Hu's result for multi-terminal arc-capacitated maximum flow problems to accommodate the general-node and arc-capacitated case. Hu and Shing present a new and interesting decomposition algorithm for multi-terminal maximum flow problems which has an improved worst case polynomial bound.

Three shortest path papers are included. The first two by Klingman and Schneider, and Phillips address finding the shortest path from one node to all other nodes, while the Goldman and Tiwari article addresses the 'all shortest path' problem. Goldman and Tiwari provide an elegant set of weakest possible mathematical conditions on the processing-order for distance-matrix entries under which the Bilde-Krarup accelerated version of the Cascade Algorithm remains valid. Klingman and Schneider address the design and implementation issues associated with developing efficient incore/out-of-core microcomputer algorithms. Specifically, they develop and test several variants of the Partitioning Shortest Path (PSP) algorithm on an IBM/PC-XT. Their results provide new insights concerning in-core/out-of-core algorithm design and illustrate the speed and flexibility of the PSP algorithm. The article by Phillips provides a new variant of the PSP algorithm which appears to improve the computational attributes of the PSP algorithm, particularly when shortest path problems are utilized in relaxation strategies.

Hung, Rom, and Waren conduct a systematic empirical study of the effects of degeneracy on a primal simplex code by developing and testing a family of increasingly degenerate problems. Their computational results provide a number of insights on the empirical effects of degeneracy. Ikura and Nemhauser report on the

implementation of a polynomial-time dual simplex algorithm for the transportation problem, which is shown to be empirically, as well as theoretically, more efficient than a standard algorithm. Their computational experience shows that scaling of supplies and demands is very effective. Mote proposes a new class of mixed integer network flow problems, called the family constrained network problem, which fits many real world problems. Based on the computational results presented, it appears that this class of mixed integer programming problems is highly amenable to solution.

A new model and branch-and-bound algorithm for the asymmetric m-travelling salesmen problem is presented in the Ali and Kennington article. The algorithm utilizes and extends the highly successful work of Held and Karp for the travelling salesmen problem to the asymmetric m-travelling salesmen problem. Computational experience for problems having up to 100 cities is presented.

Glover and Novick develop a highly efficient and novel algorithm, called the 2 quasi-greedy algorithm, for the problem of finding a minimum weight base where two disjoint sets are constrained to have a fixed number of elements. This work provides many avenues for theoretical, computational complexity, and application extensions. The last article by Hedetniemi, Laskar, and Pfaff describes a linear time algorithm for finding a minimum order dominating set in a cactus.

These thirteen papers span many of the recent developments in the network field: (1) novel hybrid modeling/solution concepts, (2) new application areas, and (3) extensions of highly efficient algorithms. We are excited by the depth and breath of research activity and expect that it will continue for many years. We would like to extend our gratitude to all of the referees, to all of the authors, and to Peter Hammer for his invitation to edit this issue and for his encouragement.

The University of Texas
Austin, Texas

Darwin D. Klingman
Nancy V. Phillips